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Sertifikaat

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Certificate

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PATENT OFFICE

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Hiermee word gesertifiseer dat
This is to certify that

the documents attached hereto are true copies of the Forms P2, P6, provisional specification and drawings of South African Patent Application No. 99/4887 filed in the name of METALSPRAY INTERNATIONAL LC

IB00/01048

Filed	:	29.07.99
Entitled	:	THERMAL SPRAYING EQUIPMENT

4

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

PRETORIA in die Republiek van Suid-Afrika, hierdie 3rd dag van August 2000
in the Republic of South Africa, this day of

Registrateur van Patente
Registrar of Patents

REPUBLIC OF SOUTH AFRICA | REGISTER OF PATENTS | PATENTS ACT,

OFFICIAL APPLICATION	LODGING DATE: PROVISIONAL	ACCEPTANCE DATE
21 01 994887	22 29-07-99	47
INTERNATIONAL CLASSIFICATION	**LODGING DATE: COMPLETE**	**GRANTED DATE**
51	23	

FULL NAME(S) OF APPLICANT(S)/PATENTEE(S)

71 METALSPRAY INTERNATIONAL LC

APPLICANTS SUBSTITUTED:	DATE REGISTERED
71	

ASSIGNEE(S)	DATE REGISTERED
71	

FULL NAME(S) OF INVENTOR(S)

72 MICHAEL WALTER SEITZ

PRIORITY CLAIMED	COUNTRY	NUMBER	DATE
N.B. Use International abbreviation for country (see Schedule 4)	33 NIL	31 NIL	32 NIL

TITLE OF INVENTION

54 THERMAL SPRAYING EQUIPMENT

ADDRESS OF APPLICANT(S)/PATENTEE(S)

9 TELFORD STREET, INDUSTRIA, GAUTENG, SOUTH AFRICA

ADDRESS FOR SERVICE	S AND F REF
74 SPOOR AND FISHER, SANDTON	JP/M 886/CB/nh

PATENT OF ADDITION NO.	DATE OF ANY CHANGE
61	

FRESH APPLICATION BASED ON	DATE OF ANY CHANGE

SPOOR AND FISHER

REPUBLIC OF SOUTH AFRICA FORM P.1
REVENUE
29.07.99 R 060.00
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REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978
APPLICATION FOR A PATENT
AND ACKNOWLEDGEMENT OF RECEIPT
(Section 30 (1) – Regulation 22)

The granting of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate

OFFICIAL APPLICATION NO.			S AND F REFERENCE
21	01	994887	JP/M 886/CB/nh

FULL NAME(S) OF APPLICANT(S)

71	METALSPRAY INTERNATIONAL LC

ADDRESS(ES) OF APPLICANT(S)

	9 TELFORD STREET, INDUSTRIA, GAUTENG, SOUTH AFRICA

REGISTRAR OF PATENTS, DESIGNS, TRADE MARKS AND COPYRIGHT
1999 -07- 29
REGISTRATEUR VAN PATENTE, MODELLE, HANDELSMERKE EN OUTEURSREG

TITLE OF INVENTION

54	THERMAL SPRAYING EQUIPMENT

THE APPLICANT CLAIMS PRIORITY AS SET OUT ON THE ACCOMPANYING FORM P.2. THE EARLIEST PRIORITY CLAIM IS:

COUNTRY:	NIL	NUMBER:	NIL	DATE:	NIL

~~THIS APPLICATION IS FOR A PATENT OF ADDITION TO PATENT APPLICATION~~ NO.

21	01	

~~THIS APPLICATION IS A FRESH APPLICATION IN TERMS OF SECTION 37 AND IS BASED ON APPLICATION~~ NO.

21	01	

THIS APPLICATION IS ACCOMPANIED BY:

- ☒ 1. A single copy of a provisional specification of 8 pages.
- ☐ 2. Drawings of 2 sheets.
- ☐ 3. Publication particulars and abstract (Form P.8 in duplicate).
- ☐ 4. A copy of Figure of the drawings (if any) for the abstract.
- ☐ 5. An assignment of invention.
- ☐ 6. Certified priority document(s) .
- ☐ 7. Translation of the priority document(s).
- ☐ 8. An assignment of priority rights.
- ☐ 9. A copy of the Form P.2 and the specification of S.A. Patent Application No.
- ☐ 10. A declaration and power of attorney on Form P.3.
- ☐ 11. Request for ante-dating on Form P.4.
- ☐ 12. Request for classification on Form P.9.
- ☒ 13. Form P.2 in duplicate.

74	ADDRESS FOR SERVICE: SPOOR AND FISHER, SANDTON

Dated: 29 July 1999

SPOOR AND FISHER
PATENT ATTORNEYS FOR THE APPLICANT(S)

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REPUBLIC OF SOUTH AFRICA
PATENTS ACT, 1978

PROVISIONAL SPECIFICATION

(Section 30(1) – Regulation 27)

OFFICIAL APPLICATION NO.		LODGING DATE	
21 01	994887	22	29-07-99

FULL NAME(S) OF APPLICANT(S)

71	METALSPRAY INTERNATIONAL LC

FULL NAME(S) OF INVENTOR(S)

72	MICHAEL WALTER SEITZ

TITLE OF INVENTION

54	THERMAL SPRAYING EQUIPMENT

THERMAL SPRAYING EQUIPMENT

BACKGROUND OF THE INVENTION

THIS invention relates to thermal spraying equipment and to a thermal spraying method for producing hard coatings on a substrate.

International patent application no. WO 98/00574 describes a thermal spraying method and apparatus of the above general kind.

It is an object of the invention to provide a method and apparatus which is a development of the known method and apparatus.

SUMMARY OF THE INVENTION

According to the invention there is provided thermal spraying apparatus comprising a nozzle defining a throat having an inlet and an outlet and a gas flow path which is aligned with the axis of the throat, so that gas under pressure can be supplied to the inlet; at least first and second guides arranged to guide respective feedstock wires via the inlet towards a point of intersection in or adjacent an end of the throat; a power supply arranged to be connected to the feedstock wires to cause an arc in the throat between the wires; and a supply of compressed air arranged to supply air to the throat, the guides being arranged to direct the feedstock wires to the point of intersection so that they define an angle of between 45° and 90° between them.

Preferably, the guides are arranged so that the angle defined between the feedstock wires is approximately 60°.

The nozzle may be formed from first and second body halves, each defining a portion of the throat.

The guides may comprise respective bores formed in the body halves and each intersecting the portion of the body half defining a respective portion of the throat, each bore being inclined relative to the axis of the throat.

The guides may include inserts receivable in the respective bores, each insert having an aperture therein through which a feedstock wire can pass, and having an inclined end face shaped complementally to the shape of the throat.

The body halves are preferably conductive, with a terminal or contact on each body half for connection to the power supply.

The body halves are preferably mounted on a non-conductive head which holds the body halves in a spaced-apart condition.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is an exploded view of a spray head of thermal spraying apparatus according to the invention;

Figure 2 is a pictorial view of the apparatus of Figure 1;

Figure 3 is a rear end view of the apparatus of Figure 1; and

Figure 4 is a section on the line 4-4 in Figure 3.

DESCRIPTION OF AN EMBODIMENT

The illustrated apparatus is a thermal spraying head which is connected in use to a source of compressed air or nitrogen by means of a hose 10, and to a high current power supply 12 in use.

The general principle of operation of the apparatus is substantially similar to that described in the abovementioned international patent application no. WO 98/00574, the contents of which are incorporated herein by reference.

The spray head of the apparatus comprises first and second conductive body halves 14 and 16 which are machined from aluminium alloy and which are mounted on a non-conductive head 16 which can, for example, be moulded or machined from a suitable plastics material such as PTFE.

As shown in the exploded view of Figure 1, the body halves 14 and 16 are attached to the head 18 hingedly by means of pins, which assist in assembly of the head and in correct location of the body halves with respect to one another. An outer sleeve 56 of tough plastics material such as nylon holds the body halves in position and is located positively by a pin 58.

The front face of the head has a circular central portion 20, at the centre of which is an outlet 22 of a nozzle which has an inlet 24, and a cylindrical throat 26 extending between the inlet and the outlet. The throat has an inlet diameter of 8mm and an exit diameter of 8.5mm.

Cavities 28 and 30 are machined into the respective body halves 14 and 16, and define respective inclined bores 32 and 34 which intersect with respective grooved portions 36 and 38 of the body halves which define the throat 26, at an angle of approximately 30° to the axis X-X of the throat, so that the included angle between the two bores 34 is 60°.

Locatable within each bore is a copper insert 40, the inserts 40 having ends 42 which are shaped complementally to the grooved surfaces 36 and 38 defining the throat of the nozzle, so that when the inserts are in position in the bores 34, their ends 42 are flush with the surface of the throat. A bore 44 is formed in each insert which is sized to receive a metal feedstock wire 46 and to make electrical contact with the wire as the wire passes through the insert and into

the throat 26.

In the prototype apparatus, the feedstock wires 46 were directed to a point of intersection at the outer end of the throat 26 essentially coinciding with the outlet 22 and the central axis X-X of the throat. In some applications, it may be desirable to move the point of intersection outside the throat, although it has been found in practice that it is generally preferred for the point of intersection to be within the throat.

Electrical terminals 48 and 50 on the respective body halves 14 and 16 are provided for connection of heavy duty conductors 52 and 54 which connect the body halves to the power supply 12, and which thus pass current to the feedstock wires 46 via the body halves and the copper inserts, causing an arc at the point of intersection of the feedstock wires in the throat. In the prototype apparatus of the invention, the power supply 12 was a constant voltage source operating at approximately 42 to 48 volts (compared with approximately 32 to 36 volts in the case of conventional apparatus). The arc current was between 150 Amperes to 300 Amperes and the gas pressure at the entrance 2 to 5 bar (g), typically 4 bar.

As described in the abovementioned international patent application, the pressure and volume of the gas supplied to the interior of the nozzle are preferably adjusted to cause sonic or choked gas flow within the throat, so that the generation of an arc within the throat has the effect of generating supersonic flow within the nozzle, which would otherwise not be attainable. The resultant high flow velocity results in very fine atomisation of the molten feedstock particles and very high particle speeds as the particles are emitted from the nozzle towards a substrate.

The feedstock wires 46 can be conventional solid wires, but it has been found that the use of cored wires comprising a tubular metallic body containing a cermet powder, together with the use of nitrogen or another suitable inert gas, provides excellent results. The cermet material, typically an agglomerated and sintered mix of metal and carbide, tends to improve the deposition of carbide material from the thermal spray method, as the hard carbide material is contained within a metal binder. Use of pure nitrogen or another suitable inert gas protects the atomised metal feedstock particles from oxidation, significantly improving the quality of the coating produced.

It has been found that utilising relatively short spray distances between the outlet of the nozzle and the substrate to be coated, preferably less than 100 mm and down to as little as 5 mm, further reduces the formation of oxides which detrimentally effect the quality of the coating. In prior art devices, short spraying distances can lead to overheating of the substrate, but due to the very high gas flow through the spray device of the invention, the gas jet has a cooling effect, preventing overheating.

It is believed that the use of a relatively steep angle of intersection between the feedstock wires of at least 45°, and typically 60°, compared with the conventional angle of intersection of approximately 30°, ensures that the ends of the feedstock wires at the point of generation of the arc are more stable in the high velocity gas stream in the throat, and that the atomisation of the molten metal resulting from the arc is more uniform due to the smaller exposed surface cross section of the feedstock wires. In this regard, the design of the wire guides so as not to protrude into the throat and therefore not to disturb the gas flow in the throat is also important.

DATED THIS 29TH DAY OF JULY 1999

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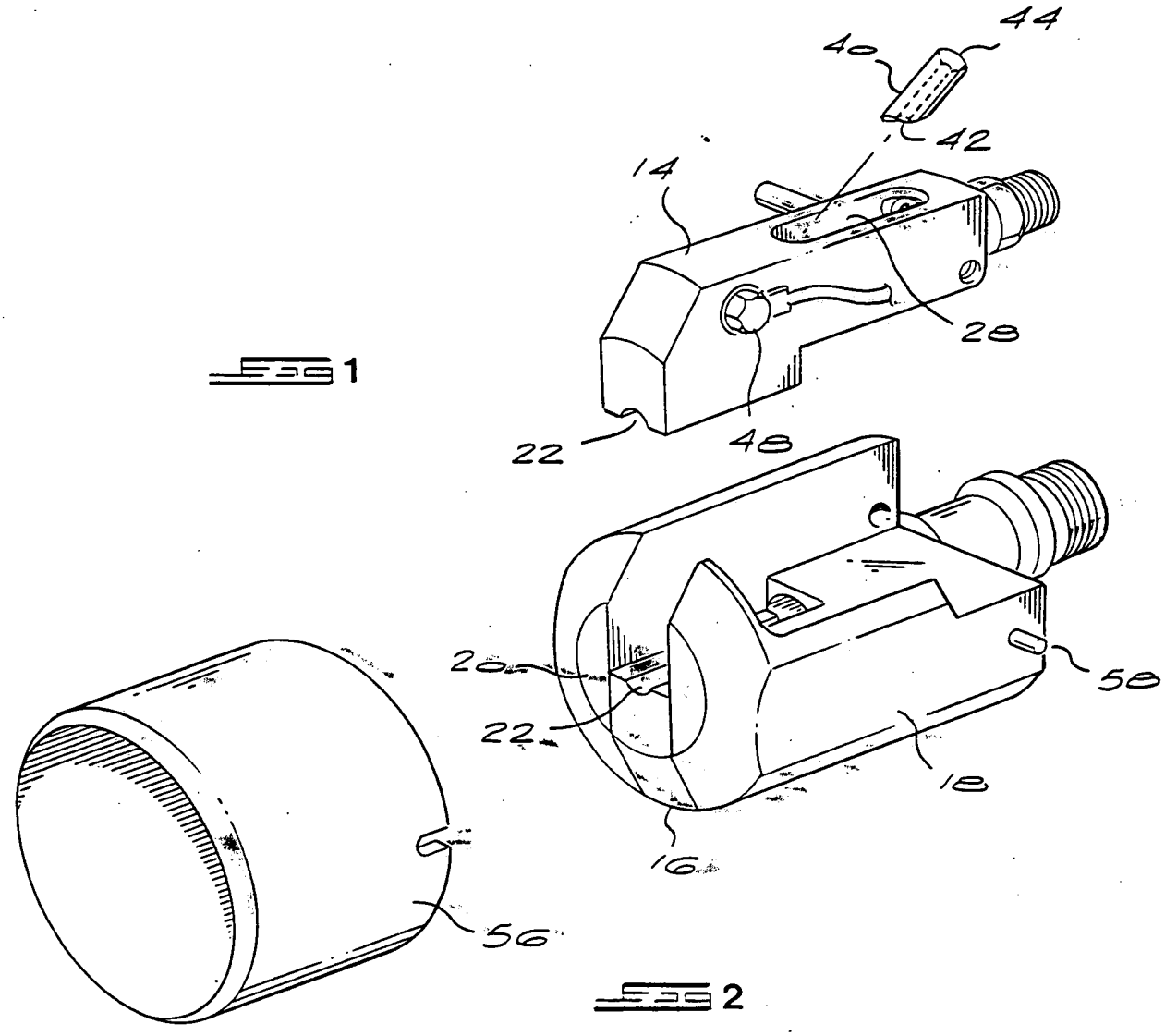

FIG 1

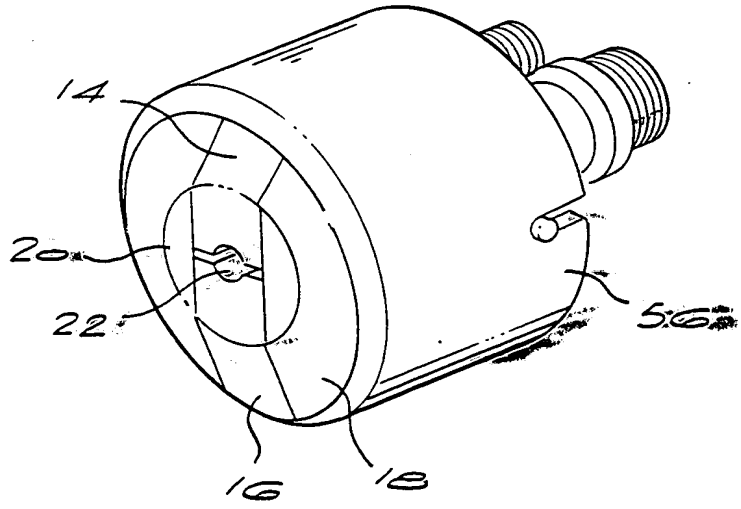

FIG 2

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FIG 3

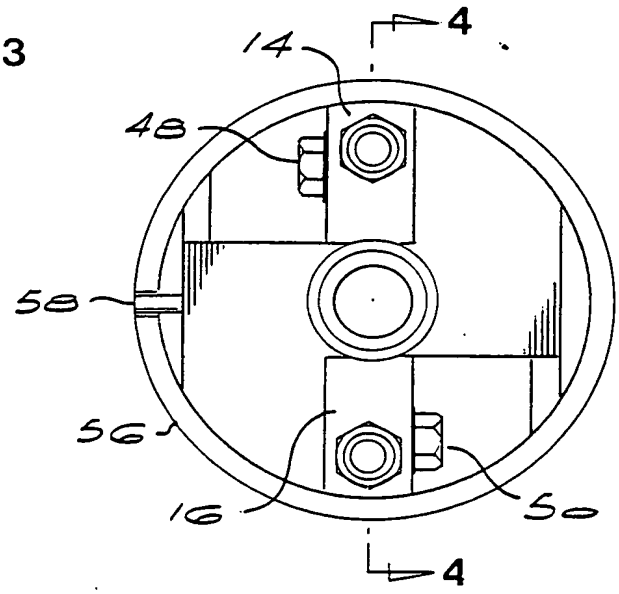
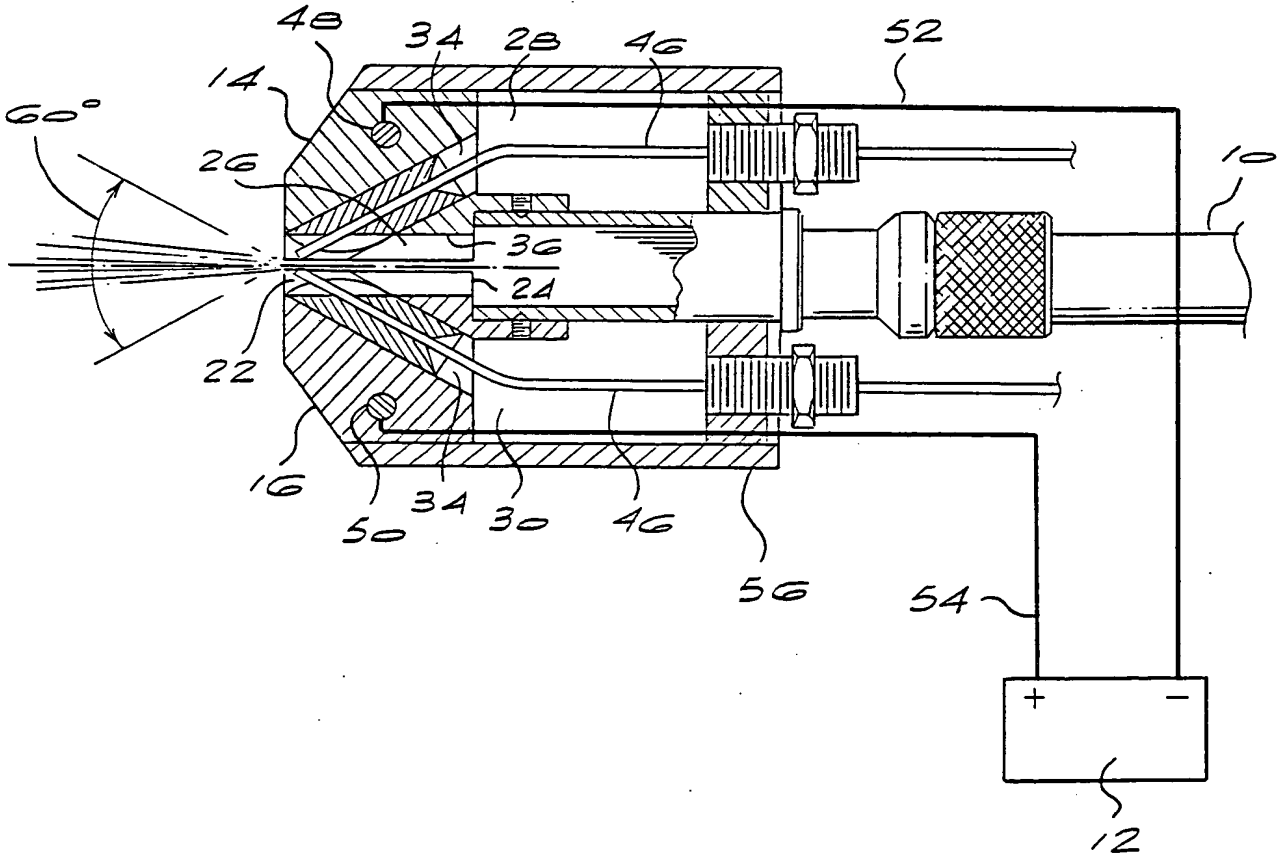


FIG 4



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